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Study of genetic variability, heritability and genetic advance for yield and yield related components of brinjal [*Solanum melongena* (L.)] genotypes

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Abstract
To investigate the genetic variability among 35 genotypes of brinjal, the experiment was laid out at SKL Telangana State Horticultural University, Hyderabad during Rabi 2017-18. The study revealed significant differences among all studied traits. Highly significant differences were observed among all the genotypes and characters under study indicating the presence of sufficient amount of variability in all the characters. PCV estimates were higher than their corresponding GCV for all characters studied. PCV and GCV were high for fruit weight (26.2,22.2%), fruit length (22.7, 20.8%), no. of fruit per cluster (21.3, 17.1%), fruit yield per plant (20.7, 18.9%),shoot and fruit borer infestation (18.4, 16.1%), total phenol content (18.3, 13.1%), whereas, plant height, no. of branches per plant, days to first flowering, days to 50 percent flowering, no. of flower cluster per plant, no. of flower per cluster, no. of fruits per plant, days to first harvest, days to last harvest and ascorbic acid content showed moderate PCV and GCV. The heritability estimates were high for all the characters. Expected genetic advance was observed to be high for fruit length (50.5%), fruits weight (49.5%), fruit yield per plant (45.7%), no. of fruits per plant (37.1%), shoot and fruit borer (36.9%), no. of fruits per cluster (36.3%), whereas moderate for fruit width, ascorbic acid content and no. of flower cluster per plant. Therefore, studied characters may be included in assortment criterion for improvement in fruit yield per plant and yield contributing traits.

Keywords: Genetic variability, heritability, genetic advance, yield, yield related, *Solanum melongena* (L.)

Introduction
Brinjal or Aubergine or Eggplant [*Solanum melongena* L. [2n=2x=24] belongs to the family Solanaceae which is one of the most important commercial vegetable crops in the world, especially in the tropics and subtropics (Kalloo, 2002) [6]. The brinjal is of much importance in the warm areas of far east, being grown extensively in India, and other Asian countries like Bangladesh, Pakistan, and Phillipines. Other major brinjal producing countries are China, Turkey, Japan, Egypt, Indonesia, Iraq, Italy, Syria and Spain. The cultivated brinjal is of Indian origin and has been in cultivation for long time. Now, India is considered as center of origin and diversity of brinjal (Vavilov, 1951; Isshiki *et al*., 1994) [10, 4]. It originated in India but has a secondary canter of variation in China. Various forms, colours and shapes of eggplant are found throughout Southeast Asia, suggesting that this area is an important center of variation and possibly of origin.

Being the centre of origin, India has accumulated with wide range of variability in this crop, and exhibits a good amount of variability for various characters. However, regional preference differs greatly with size, shape, colour of fruits and prickles on the calyx. This has created the necessity to breed new brinjal varieties, which may fulfil the area specific needs of the growers. Planning and execution of a breeding programme for the improvement of the various quantitative attributes depend, to a great extent, upon the magnitude of genetic variability and divergence existing in the population. Hence Co-efficient of variation is useful in the assessment of genetic variability for the particular characters. The genetic variability forms the basis of the entire breeding programme. Selection cannot be effective in population without variability. In terms of variability, it is the genetic fraction of the observed variation that provides a measure of transmissibility of the variation under study and responds to selection.

Heritability is an index of transmission of characters from parents to their offspring (Falconer, 1989). Heritability denotes the proportion of phenotypic variation repeatable and is due to genes and thus helps the breeders to select the elite variety for a character (Koundinya *et al.* 2013) [7]. High heritability alone is not enough to make efficient selection, unless information is accompanied by substantial amount of genetic advance (Johnson *et al.*, 1955) [5].

Genetic advance denotes the improvement in the mean values of selected families over the base population (Singh, 1983) [9] and thus helps the breeder to select the progenies in the earlier generation itself. In view of the above, the present investigation was taken up to study the genetic variability parameters among the germplasm lines,

Materials and Methods

A field experiment to investigate the genetic diversity in 35 genotypes of brinjal was laid out in Randomized Rlock Design (RBD) with three replications at PG Research Block, Department of Vegetable Science, SKLTSHU, Rajendranagar, Hyderabad, during Rabi 2017-18. The experimental material comprised of thirty five genotypes collected from NBPGR, Hyderabad. Planting of each genotype was done with inter and intra row spacing of 45 cm x 60 cm. Observations were recorded on five randomly selected plants in each plot on nineteen different traits. Plot means over the replications were used for the statistical analysis. Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were calculated as per the formula suggested by Comstock and Robinson (1952) [2]. Heritability (broad sense) was worked out using the formula given by Burton (1952) [1] and Johnson *et al*. (1955) [5] and Hanson *et al*. (1956) [3]. Genetic advance and genetic gain were calculated as per the formula suggested by Lush (1949) [8] and Johnson *et al*. (1955) [5].

Result and Discussion

A thorough screening of the germplasm material studied under present investigation revealed sufficient variability for fourteen quantitative, two qualitative and three pest & disease incidence characters *viz*., plant height (cm), number of branches per plant, number of flower clusters per plant, number of flowers per cluster, number of fruits per cluster, number of fruits per plant, days to first flowering, days to 50% flowering, days to first harvest, days to last harvest, fruit length (cm), fruit width (cm), average fruit weight (kg), fruit yield per plant (kg), ascorbic acid content (mg/100g), total phenol content (mg/100g), shoot and fruit borer infestation (%), cumulative wilt incidence (%), little leaf incidence (%).

Morphological traits

Plant height (cm) had high phenotypic and genotypic variances of 30.98 and 19.27, respectively were recorded coupled with low PCV and GCV of 5.96 and 4.70 per cent, respectively. This trait showed high heritability (62.2%), moderate genetic advance (9.13) and moderate GA as% mean (9.79%). Number of branches per plant showed very low phenotypic and genotypic variances of 1.26 and 0.81, respectively with moderate PCV (8.51%), low GCV (6.82%), high heritability (64.4%), low genetic advance (1.91) and moderate GA as% of mean (14.46).

Floral characters

For the character days to first flowering, high phenotypic and genotypic variances of 17.73.55 and 16.66, respectively were recorded in brinjal genotypes with moderate PCV (9.79%) and low GCV (9.48%) values. Days to first flowering showed high heritability (94.0%), but moderate genetic advance (10.44) and high GA as% of mean (24.28). The trait days to 50 percent flowering recorded higher phenotypic and genotypic variances of 19.87 and 14.07, respectively with moderate PCV (9.53%) and low GCV (8.02%), high heritability (70.8%), moderate genetic advance (8.33) and high GA as% of mean (17.83). for number of flower clusters per plant, the moderate phenotypic and genotypic variances of 6.15 and 4.70, respectively were recorded coupled with moderate PCV and GCV of 13.69 & 11.97 per cent, respectively. This trait showed high heritability (76.5%), low genetic advance (5.00) and high GA as per cent mean (27.64). Number of flowers per cluster recorded low phenotypic and genotypic variances *viz*., 0.19 & 0.13, respectively coupled with high PCV and moderate GCV of 11.98 and 10.09 per cent, respectively. This trait showed high heritability (70.8%), low genetic advance (0.81) and high GA as per cent mean (22.42).

Yield and yield related parameters

Number of fruits per cluster had Low phenotypic and genotypic variances *viz*., 0.16 and 0.10, respectively were recorded coupled with high PCV and GCV of 21.36 and 17.15 per cent, respectively. This trait showed high heritability (64.5%), low genetic advance (0.68) and high GA as per cent mean (36.36). Number of fruits per plant exhibited high phenotypic (10.29) and genotypic (9.50) variances, high PCV (15.22%), GCV (14.62%), high heritability (92.3%), moderate genetic advance (7.82) and high GA as% of mean (37.09). With respect to days to first fruit harvest, high phenotypic (34.43) and high genotypic (28.65) variances, low PCV (9.64%) and low GCV 8.79 (%), high heritability (83.2%), moderate genetic advance (12.89) and moderate GA as% of mean (21.18) estimates were observed for this trait. High phenotypic and genotypic variances viz., 33.91 and 25.38, respectively with low PCV (3.97%), GCV (3.46%), high heritability (74.9%), moderate genetic advance (11.50) and high GA as per cent of mean (7.84) estimates were observed for days to last fruit harvest. With regard to fruit length, moderate phenotypic and genotypic variances of 7.31 and 6.17, respectively with high PCV (22.67%), GCV (20.83%), high heritability (84.4%), low genetic advance (6.02) and high GA as per cent mean (50.51).Fruit width (cm)recorded very low phenotypic and genotypic variances of 0.74 and 0.54, respectively with moderate PCV (16.84%), GCV (14.38%) values, high heritability (73.0%), low genetic advance (1.65) and high GA as per cent of mean (32.44).Average fruit weight (kg) registered with high phenotypic (0.01) and genotypic (0.01) variances, high PCV (26.28%) and GCV (22.20%) were recorded for average fruit weight. High heritability (71.4%), high genetic advance (0.55) and high GA as per cent of mean (49.54) estimates were recorded. Fruit yield per plant (kg) had very high phenotypic (0.19) and genotypic (0.16) variances were registered for fruit yield per plant with moderate PCV (20.76), GCV (18.97%), high heritability (83.6%), very high genetic advance (0.09) and high GA as per cent of mean (45.79).

Quality parameters

Ascorbic acid content (mg/100g) exhibited low phenotypic (0.79) and genotypic (0.61) variances, high PCV (14.38%), GCV (12.80%), high heritability (79.2%), low genetic advance (1.83) and high genetic advance as per cent of mean (30.09). 4.4.16 Total phenol content (mg/100g) exhibited high phenotypic (73.19) and genotypic (37.07) variances, moderate PCV (18.28%), GCV (13.01%), high heritability (50.7%), high genetic advance (11.44) and high GA as per cent of mean (24.45).

Shoot and fruit borer infestation (%)
Exhibited high phenotypic (9.46) and genotypic (7.17) variances, high PCV (18.46%) and GCV (16.07%), high heritability (75.90%), moderate genetic.

From the present study, it is concluded that the PCV and GCV were high for plant height, days to first fruit harvest, days to last fruit harvest, fruit length, fruit yield per plant, total phenol content and shoot and fruit borer infestation indicating the existence of wider genetic variability for these traits in the genotypes under study for further improvement. Low estimates of genotypic and phenotypic coefficient of variations were observed for, fruit width, number of fruits per plant, number of fruits per cluster, average fruit weight, ascorbic acid content and suggesting narrow range of genetic variability for these traits.

Table 1: Estimates of variability, heritability and genetic advance as percent of mean for 19 characters in 35 genotypes of brinjal

S. No	Characters	Range		Mean	Variance		PCV (%)	GCV (%)	h^2_{bs} (%)	Genetic Advance	GA as per cent of mean
		Minimum	Maximum		Phenotypic	Genotypic					
1	Plant height (cm)	83.63	104.19	93.35	30.98	19.27	5.96	4.70	62.2	9.13	9.79
2	No. of branches per plant	10.99	15.00	13.20	1.26	0.81	8.51	6.82	64.4	1.91	14.46
3	Days to first flowering	36.90	54.67	43.02	17.73	16.66	9.79	9.48	94.0	10.44	24.28
4	Days to 50% flowering	37.67	57.67	46.75	19.87	14.07	9.53	8.02	70.8	8.33	17.83
5	No. of flower clusters per plant	14.73	24.27	18.11	6.15	4.70	13.69	11.97	76.5	5.00	27.64
6	No. of flowers per cluster	3.00	4.27	3.65	0.19	0.13	11.98	10.09	70.8	0.81	22.42
7	No. of fruits per cluster	1.10	2.50	1.89	0.16	0.10	21.36	17.15	64.5	0.68	36.36
8	No. of fruits per plant	15.33	26.33	21.08	10.29	9.50	15.22	14.62	92.3	7.82	37.09
9	Days to first harvest	51.67	72.00	60.87	34.43	28.65	9.64	8.79	83.2	12.89	21.18
10	Days to last harvest	132.33	157.67	146.62	33.91	25.38	3.97	3.46	74.9	11.50	7.84
11	Fruit length (cm)	8.16	16.90	11.92	7.31	6.17	22.67	20.83	84.4	6.02	50.51
12	Fruit width (cm)	3.17	6.49	5.10	0.74	0.54	16.84	14.38	73.0	1.65	32.44
13	Average fruit weight (kg)	0.03	0.19	0.11	0.01	0.01	26.28	22.20	71.4	0.55	49.54
14	Fruit yield per plant (kg)	1.53	3.07	2.12	0.19	0.16	20.76	18.97	83.6	0.97	45.79
15	Ascorbic acid content(mg/100g)	5.77	7.44	6.10	0.79	0.61	14.38	12.80	79.2	1.83	30.09
16	Total phenol content (mg/100g)	26.83	59.23	46.79	73.19	37.07	18.28	13.01	50.7	11.44	24.45
17	Shoot and fruit borer infestation (%)	12.93	24.56	16.66	9.46	7.17	18.46	16.07	75.9	6.16	36.97
18	Cumulative wilt incidence (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	Little leaf incidence (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

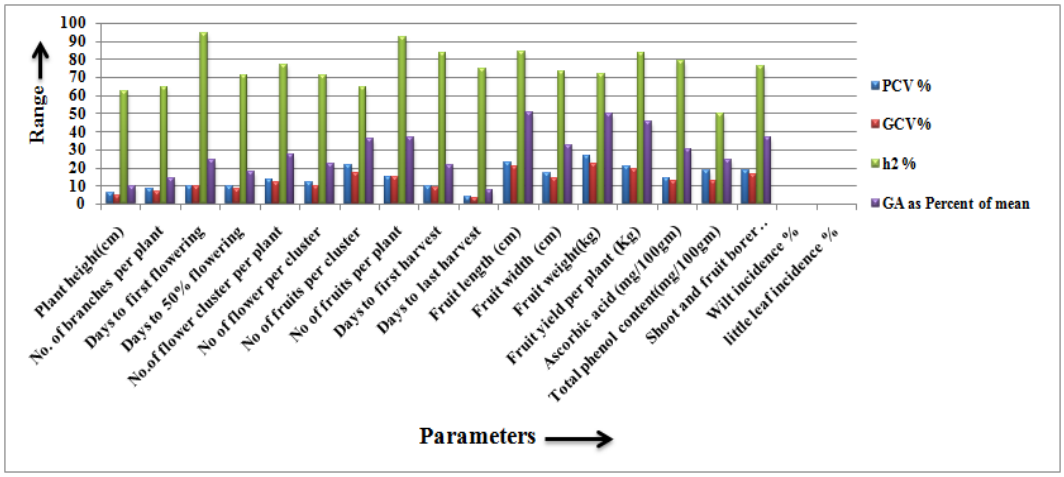

Fig 1: Estimation of variability, heritability and genetic advance as per cent of mean for nineteen characters in 35 genotypes of brinjal

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